ECE 214 – Electrical Circuits Lab Lecture 3

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Announcements

- Lecture cancelled due to snow *again*.

- Be sure to get your pre-lab and labs checked off.
  We have been bad at enforcing this.
  Ideally do it at end of lab section, but you have until the beginning of the next lab to get it done.

- Put everything you can think of in your lab notebook. Steps you took, buttons you press, equations, etc. Midterm/final/etc will be open lab notebook. Want

to have enough to reproduce the results you get.

Notes from Lab #2

- Measuring the impedance of your DVM.
  Easiest way to do it is just a simple voltage divider with a fairly large (1M or higher) resistor and DC power supply. If doing it with AC power supply (function generator) then you have to take into account your voltmeter measures RMS voltage.
  Most common DVMs have an input resistance of around 10M.

- Explain Function Generator / Oscilloscope mismatch

- Explain square wave FFT. Square wave sum of sine waves. sine $+ 1/3$ third harmonic $+ 1/5$ fifth harmonic, etc.

- Explain low-pass first-order RC filter behavior. First order filter of 6db per octave, or roughly 20db per decade.

- Crossover frequency at $\frac{1}{2\pi\tau}$, or $\frac{1}{2\pi RC}$

- Instead of sketching graphs, it is OK to take pictures of the oscilloscope screen and paste in your lab notebook.

- How is microcap and Matlab/Octave going?

Lab #3 – RC Filters

- In this lab you will design an RC Filter.

Pre-Lab

- Calculate values

- Try to make it with realizable parts.
  No 1F capacitors or 1micro-ohm resistors.

- Micro-cap simulation

- Why 6dB?
  6dB per octave, equivalent to half value.
  2*log(.5) is roughly 6.

Hints

- You want a filter that will reduce the first harmonic while leaving the higher ones alone (a high-pass filter).

- Pick a crossover frequency, and use the equation of $\frac{1}{2\pi\tau}$, or $\frac{1}{2\pi RC}$ to find values for R and C.

- If a first-order filter does not reduce fast enough to get the dB drop that you want, consider making it into a second-order filter.

- Additional hint; having two identical filters back to back

(to make it second order) can have interference issues that impair its functionality. For a second filter you might try scaling the resistor up by a factor of 10 and the capacitor down by a factor of 10 (should still have the same time constant).

Lab

- Straightforward, put together what you designed in the pre-lab and fine-tune until you get the results asked for.